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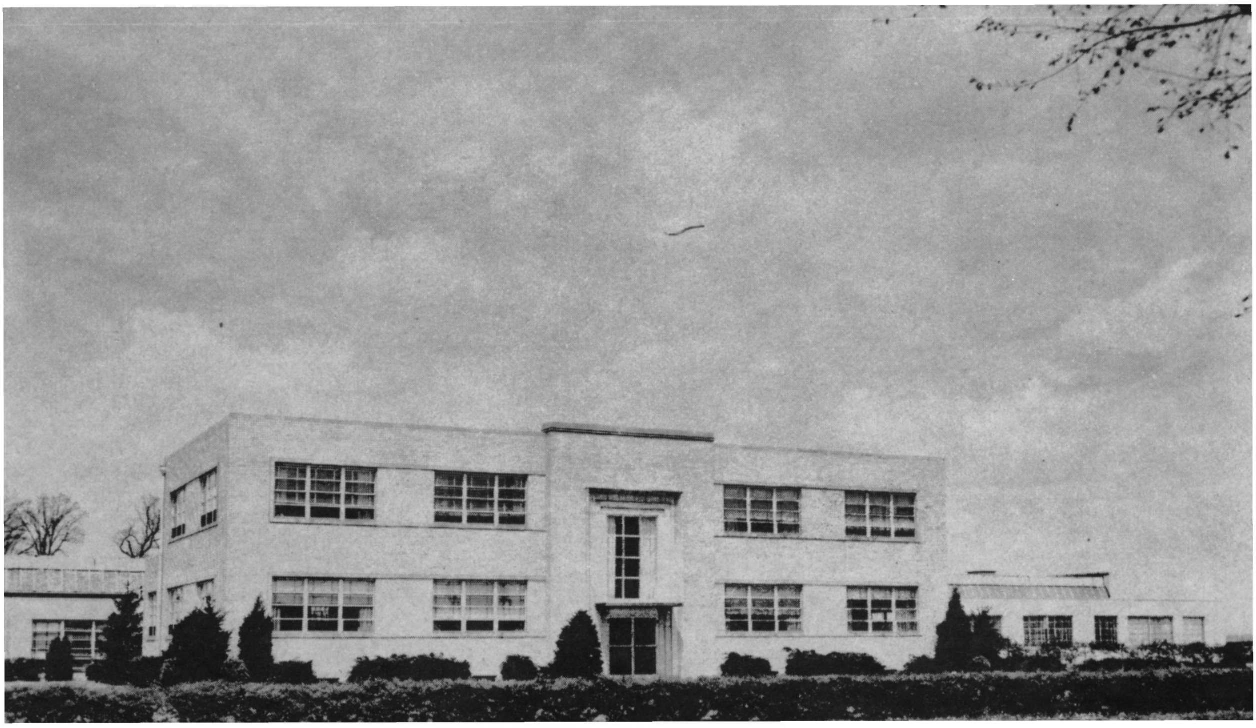

RESEARCH FOUNDATION

Columbus 8, Ohio

USNC-IGY ANTARCTIC GLACIOLOGICAL DATA
FIELD WORK 1958 AND 1959

(Geology of the Horlick Mountains)

Report 825-2-Part VII
IGY Project No. 4.10
NSF Grant No. Y/4.10/285

Richard P. Goldthwait
September 1959

USNC-IGY ANTARCTIC GLACIOLOGICAL DATA

Report No. 2: Field Work 1958-59

Part VII

GEOLOGY OF THE HORLICK MOUNTAINS

Ohio State University
Research Foundation
Columbus 12, Ohio

Project 825, Report No. 2, Part VII

submitted by

Richard P. Goldthwait
Department of Geology

to the

U. S. National Committee for the IGY
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TABLE OF CONTENTS

PRELIMINARY REPORT OF THE GEOLOGY OF THE CENTRAL RANGE
OF THE HORLICK MOUNTAINS, ANTARCTICA

by

William E. Long

LIST OF FIGURES

PRELIMINARY REPORT OF THE GEOLOGY OF THE CENTRAL RANGE OF THE HORLICK MOUNTAINS, ANTARCTICA

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INTRODUCTION

Location of Area

The stratigraphic section described in this paper is located in the central group of the Horlick Mountains, which extend from Longitude 130°W to Longitude 85°W, roughly following the 85th parallel. The more exact location of the stratigraphic section within the range is 84°44.8'S, 113°44'W. This group of mountains is about 20 miles long and 5 to 10 miles wide. The northern limit of the range is sharply marked by an escarpment that forms impressive cliffs and an almost continuous front. The southern limit of the mountain group is not so well defined because of the higher ice cap surface to the south and the southerly dip of the mountain blocks. The eastern and western ends of the mountains are quite sharp suggesting transverse faulting perpendicular to the major escarpment.

Purpose of Investigation

During a reconnaissance flight over the route of the Byrd Station 1958-59 over-snow traverse which was to pass along the front of the Horlick Range, the sedimentary aspect and structure of the mountains was noted. Plans were made to include a visit to this portion of the range during the course of the traverse.

The party of six in three Sno-Cats left Byrd Station on November 1, 1958, to make seismological, glaciological, and geological investigations of the ice cap. When the course of travel reached the appropriate position for easy access to the mountains, the vehicles were turned toward the rock and driven to within three miles of the snow-rock junction. Surface roughness at this point broke the crevass detector boom and the Horlick Mountain camp was established. On 6 December 1958 four members of the traverse party set out to make a geological investigation of the rocks that formed the mountains. The party consisted of Dr. Charles Bentley (traverse leader), Jack Long, Fred Darling and the author. The party climbed 4,000 feet to the summit of one peak making collections and measurements of attitudes and elevations. Nineteen hours after leaving the camp the last of the group returned to the camp.

Method of Investigation

The investigation of the rocks of the Horlicks was made on foot, carrying back-packs for equipment and sample collecting. An aneroid barometer was carried and read at critical locations. A second barometer was read at intervals at camp to account for atmospheric changes in pressure. All readings of rock attitudes were made with a Brunton compass. Rock specimens were catalogued and packed the day after the collection was made. The summit of the mountain, Mt. Glossopteris, which provided the data for this paper was marked with a 4 x 4 redwood beam about six feet long, and a container with the party identity and date was placed at the base of a small cairn in the highest rocks just west of the snow summit.

The surveying of the mountains here and along the entire traverse was done by U. S. Geological Survey Cartographer, William Chapman, using a Kern IKM2 theodolite. Elevation of over-snow traverse stations was determined by a chain of simultaneously read altimeters.

ACKNOWLEDGEMENTS

The material in this paper has been presented with the help of Dr. G. Arthur Cooper for dating of the brachiopods; Dr. James Schopf, U. S. Geological Survey, for paleo-botanical dating and advice; Dr. Samuel Treves, University of Nebraska petrologist who advised and aided with rock identifications and interpretations; and Dr. Warren Hamilton, U. S. Geological Survey, for analysis of a basement rock specimen. Credit is given to Dr. Charles Bentley, traverse leader, and Jack Long for their assistance in collecting the samples. Fred Darling, assistant glaciologist, helped with the altimetry and note taking on the mountain, and finding the glossopteris fossils. To William Chapman, U. S. Geological Survey, goes the credit for the mapping and surveying of the mountains.

GEOGRAPHY

The Horlick Mountains are a continuation of the mountain chain that extends from Cape Adare along the eastern border of Victoria Land to the Queen Maud Range. The structure and rock types are strikingly similar along the whole mountain chain. They are usually bounded on the north by an escarpment which is an imposing wall. The mountains are massive, tabular blocks which dip slightly to the south.

The area on the old maps marked Horlick Mountains consist of three ranges, each range including numerous peaks. The westernmost range has the highest summits which reach elevations of about 12,800 feet with approximately 5,000 feet relief between ice cap level and summits. The central range is composed of peaks of slightly less than 10,000 feet elevation with 4,000 feet relief between peaks and the snow surface. The eastern Horlick Range consists of 8,000 to 9,000 foot peaks and the relief is about 3,000 feet.

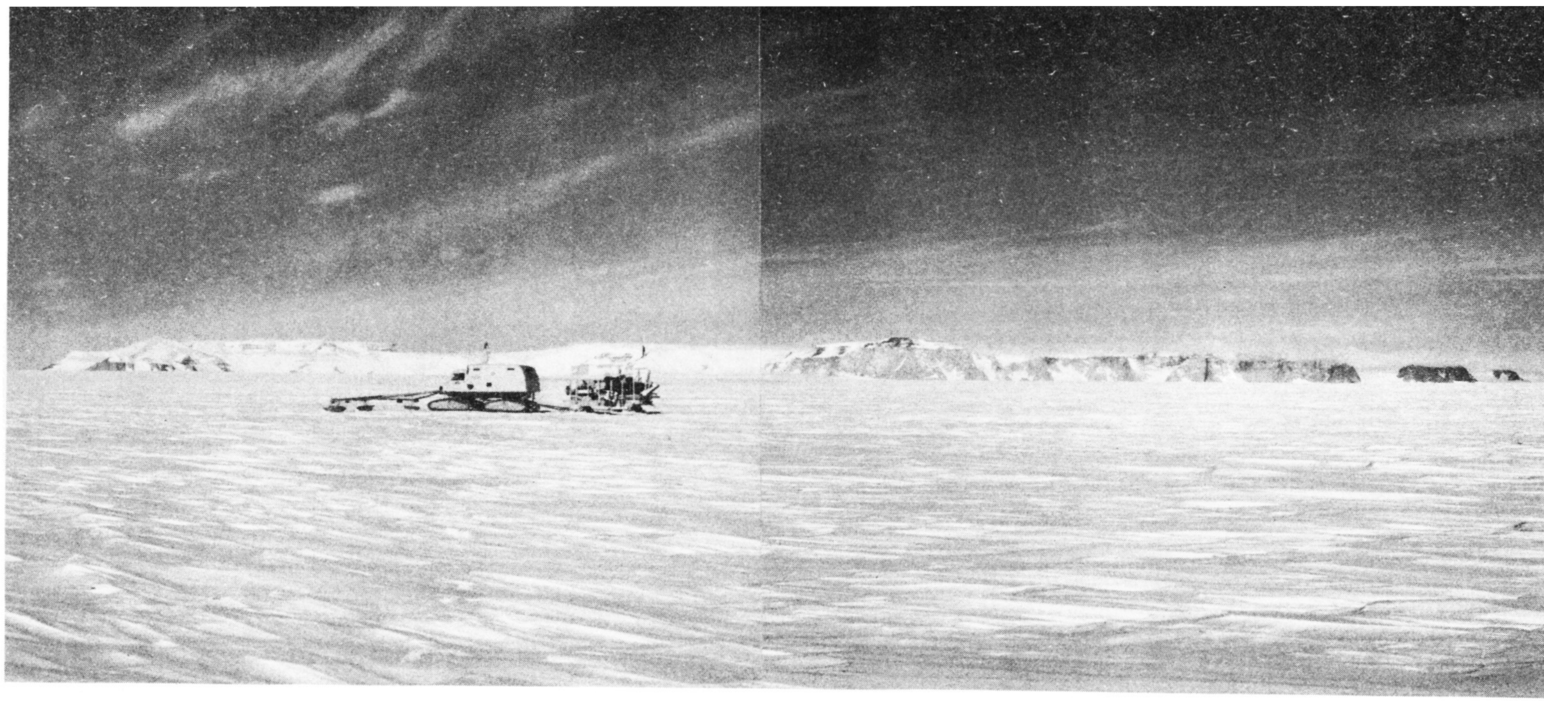
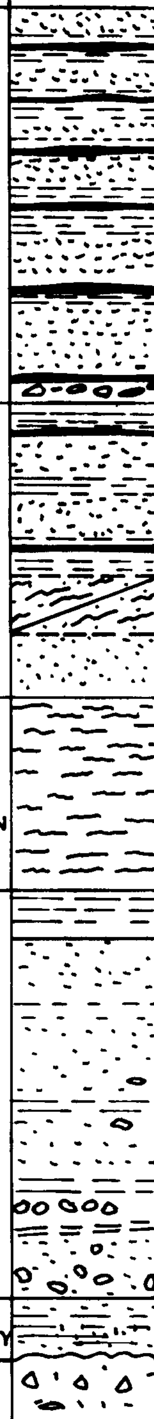


Fig. 1 Horlick Mountains, Central Range, Mt. Glossopteris is pyramidal peak on eastern (left) end of range. Inner plateau in center with basement rock more exposed on northwestern end of range.

Fig. 2 Mt. Glossopteris (proposed name) from camp at mile 414 of Byrd Traverse 1958-59.

Fig. 3 Inner plateau, looking to the southwest from upper slopes of Mt. Glossopteris. Clouds cover surface of the plateau.

MOUNT GLOSSOPTERIS GEOLOGIC SECTION

ELEVATION ON MTN. IN FT.	SERIES	FORMATION	COLUMNAR SECTION	THICKNESS IN FEET	SAMPLE	DESCRIPTION OF BEDS
10,000 8,160	PERMO-CARBONIFEROUS	UPPER BEACON		1860	H-23 H-22 H-21 H-20 H-19 H-11? H-17 H-18 H-16	SANDS, SHALES, COAL BEDS {50-100 BEDS 1 IN. - 2 FT. RHYTHMIC CYCLES, CROSS BEDDING PLANT REMAINS, WOOD & LEAVES, GLOSSOPTERIS PETRIFIED WOOD SECTIONS TO 18 IN. DIAM. QUARTZ PEBBLE CONGLOMERATE, BASE L.B. TOP, QUARTZ PEBBLE HILL
7,790	CARBONIFEROUS	LOWER BEACON		350	H-15 H-14 H-13 H-12 H-11? H-10	SANDS, SHALES, COAL FEWER COAL BEDS & PLANT FOSSILS CYCLIC NATURE LESS PRONOUNCED
7,510						FAULT ZONE DISPLACEMENT 200 FT.±
7,370				140	H-9	MASSIVE SANDSTONES, BASE OF BEACON
6980	?	FORMATION		385	H-8 H-7	CARBONACEOUS, FISSILE SHALE VERY DARK GREY
6805	DEVONIAN			175	H-6	PLATY, SANDY SHALE, DARK GREY; WORM BURROWS
5,895				910	H-5 H-24	GRAYWACKES, MASSIVE TO THIN BEDDED INTERBEDS OF CONGLOMERATES, SHALES, SANDS. OCCASIONAL GRANITIC BOULDERS, DARK COLORED BEDS LIGHT GREY SILTSTONE, FEW INCHES TO FEW FEET THICK BASAL CONGLOMERATE
5,805	L. DEV.	UN-CONFORMITY		90	H-4 H-3 H-2	QUARTZ SANDS, CALCAREOUS, FOSSILIFEROUS; SHALES,
					H-1	BASEMENT ROCK, COARSE GRAINED PINK ORTHOCLASE PHENOCRYSTS, BIOTITE QUARTZ MONZONITE

Samples of the stratigraphic section described in this report were collected from Mt. Glossopteris in the Central Horlick Range. The peaks of the Central Range form an asymmetrical arc concave toward the south (Fig. 3). The central part of the arc has an elevation of about 8,000 feet and is from 10 to 15 miles wide and is a raised ice plateau which is ringed by peaks.

The rock is well exposed on the mountain slopes that are steep and high enough so that the wind prevents accumulation of snow. Where there is no snow cover, the exposures are excellent because no vegetation, not even lichens, exist in this area.

The ice cap, in general, flows from the south to the north, nearly perpendicular to the trend of the range. The ice is forced to flow to the east and west of the range. Here crevasses indicate that normal flow of ice has been disturbed. Crevasse areas related to the sub-ice rock structure were also regularly distributed in the undulating firn surface between the ranges.

Air temperatures in the area never rise above freezing so that there is no water to form streams or lakes. Hence, no erosional features caused by water flowing are present. Erosion appears to be similar to desert or arid type. Little chemical erosion seems to occur. The dominant erosional process, of course, is the glaciation by the ice cap flowing around the peaks and the glaciers that have formed within the mountains and drain out to meet the ice cap carrying the debris from the mountains.

STRATIGRAPHY

Basement Rocks

The granitic basement rocks crop out along the entire length of the Horlick Ranges. The amount of exposure is variable and is directly related to the faulting which formed the ranges. The section reported on here was selected for study because the contact between sedimentary rocks and the basement was near ice cap level and more sedimentary rocks were exposed (Fig. 1). Western portions of the range consisted almost entirely of granitic rocks as the blocks was raised in the north and the north-north west.

The granitic basement rocks are weathered and have a brownish appearance from a distance. Fresh specimens of the basement (at a point beneath the sediments) is a pinkish, porphyritic, biotite, quartz monzonite with phenocrysts of pink orthoclase up to two inches long. Lighter and darker dike-like masses of igneous rocks intrude the quartz monzonite (Figs. 4 and 5). The upper surface of the basement rock is an undulating surface and appears to be an old erosion surface. It is this slightly rolling surface upon which the sediments were deposited (Figs. 6 and 7).

Basal Sedimentary Rocks (Figs. 4 and 5)

Above the quartz monzonite a group of clastic sediments include calcareous, fossiliferous sandstone; upper lower Devonian in age; poorly-

Fig. 4 Basement rocks and contact with basal sedimentary rocks.

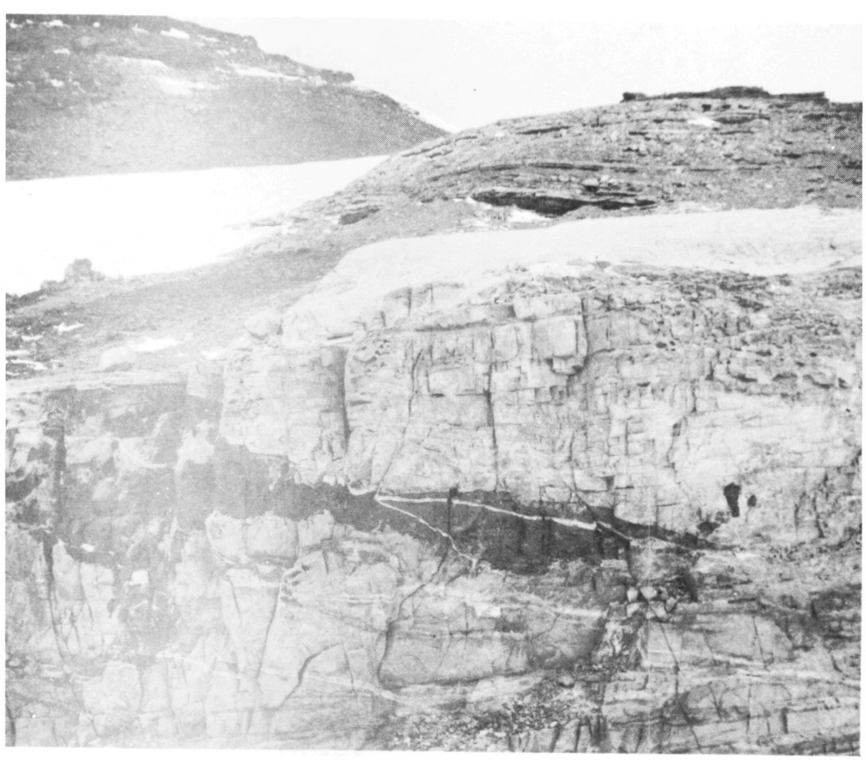


Fig. 5 Basement rock and contact with basal sedimentary rocks. Dark and light dike-like bodies.

Fig. 6 Basement rock--sedimentary rock contact. A portion of the old erosion surface has been exposed.

Fig. 7 Basement rock--sedimentary rock contact. Slightly rolling nature of old surface seen in fault block nunatak north of Mt. Glossopteris.

sorted, quartz and arkosic sandstones; and finer, silty beds. Immediately above the intrusive rock there is a coarse, light-tan, poorly-sorted sandstone which ranges from 10 to 20 feet thick. It is poorly cemented and contains quartz grains as large as one-half inch in diameter. These light-tan sands grade into coarse grained, medium gray, calcareous sandstones which contain brachiopods. Several of the fossiliferous beds are separated from each other by beds of silt. The basal portion of the fossiliferous zone produced the largest number of brachiopods (Terabratuloid similar to Rensselaeria falklandica Clarke). The interbedded siltstone is very fine-grained, dark gray, (shale-like and thinbedded) which ranges from a few feet to a few inches thick. Mica flakes are common in the siltstones and the shales.

The total thickness of the basal sedimentary group is 90 feet, the lower limit being the basement quartz-monzonite and the upper limit the contact with the overlying basal conglomerate of the graywacke sequence.

Graywacke Series

Conformable overlying the basal sedimentary rocks are beds of graywacke approximately 900 feet thick (Figs. 8 and 9). The base of the series is marked by a poorly-sorted boulder conglomerate (Fig. 10) which contains boulders up to one foot in diameter and quartz and lithic grains. The upper boundary of this series is marked by a platy, silty shale which breaks neatly along bedding planes and forms flat, pavement-like surfaces (Fig. 12).

The bulk of the graywacke is medium to dark gray and is poorly sorted. Occasional, more resistant beds from 10 to 30 feet thick form step-like features in the graywacke section (Fig. 11). Randomly located well-rounded, granitic boulders up to a foot in diameter are scattered throughout the beds of the finer material, and interspersed throughout the graywacke are thinner beds of shale and siltstone. A bed of siltstone near the base of the series is prominent because of its light gray color and very fine, well sorted grains. Several of the beds are composed of conglomeratic material which is especially common in the step-like parts of the section.

Graywacke have been described from the Robertson Bay area and from the Edsel Ford Ranges. At both locations the rocks are slightly metamorphosed and show anticlinal and synclinal structures which are not present here. Samples collected by Richard Cameron in the Robertson Bay area do not appear similar to the Mt. Glossopteris rocks. The differences are mainly attributable to the metamorphic structural characteristics of the Robertson Bay rock.

The age of the Robertson Bay group is not known but is assumed to be pre-Carboniferous (early Paleozoic or Precambrian) and older than the Beacon group, though this relationship has not been observed.

The graywackes of the Princess Martha Coast area are slightly metamorphosed and are from 2,000 to 6,000 feet thick. Diabase sills have invaded these rocks. No diabase was present in the rocks seen in the Horlick Mountains, with the exception of the possibility which will be discussed later.

Fig. 8 Ridge of graywacke. Spur directly behind camp (3 miles distant) was investigated. Photo below shows face behind right hand Sno-Cat.

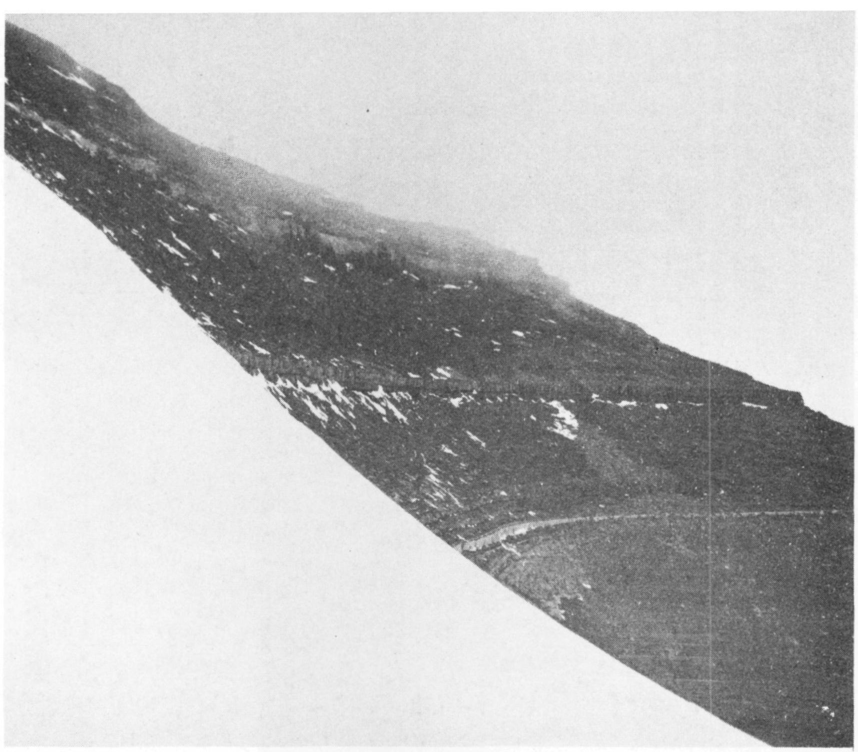


Fig. 9 Mt. Glossopteris graywacke sequence.

Fig. 10 Basal conglomerate of the graywacke unit.

Fig. 11 Finer grained rocks midway in graywacke unit.

Fig. 12 Platy siltstone is upper unit of graywacke series. Soft shale above eroded away leaving long ridge seen in Fig. 8.

At present there is no reason to believe that the rocks of the Robertson Bay group are equivalent to the Mt. Glossopteris rocks.

Dark-Gray, Friable Shale Member

This shale unit is characteristic because of its soft, easily erodible nature. It is a very dark gray, fissile, friable shale. The lower boundary is marked by a conformable contact with the platy shale at the top of the graywacke sequence. Its upper limit is the conformable contact with the massive, cliff-forming sandstone that marks the lowest rocks of the group in this section. The shale is 380 feet thick and is quite constant throughout. The soft and flaky nature as well as the very dark gray color are distinctive properties of the shale. The softness is reflected in the east with which it is eroded as is evidenced by the nearly half-mile long ridge top exposure of the underlying hard, platy shale (Fig. 11).

Massive Sandstone Bed and Fault Zone

Conformably above the very dark gray shales lies the first massive sand of the Beacon series. It is 140 feet thick and the upper contact is a fault. Massive sandstone and variable bedded sandstone characterize the basal sedimentary rocks of the group that has been called Beacon all along the mountains from Northern Victoria Land to the Queen Maud Range. Only a few feet, less than 140, of the Beacon lie above the dark, friable shale before the Beacon is slightly displaced by a small fault.

The fault and associated fault zone disrupt the even, nearly level bedding for a small distance (Fig. 14) after which the nearly level attitude of the strata continues. Two normal faults bound the zone; the lower dips at 60° to the east (Fig. 13) and the upper could not be measured but was marked by the change of attitude and fault-breccia. The faults are not a major structural feature and no major effect is shown. Above the fault zone the Beacon group sedimentary rocks continue undisturbed.

The Beacon Series

The Beacon series is the best known of the Antarctic sedimentary rock units. Exposures occur along the length of the mountainous belt that has been called the Antarctic Horst. They are exposed in the northern escarpment of the mountains that form a continuous pattern from the Royal Society Range along the peaks bordering Victoria Land, the Queen Maud Range, and the Horlick Range. The extension of these rocks to the East is indicated by the rocks discovered by the British Trans-Antarctic Expedition in the Theron Mountains in Coats Land.

The Beacon series was named by Ferrar during the National Antarctic Expedition, 1901-04. Ferrar noted the nearly horizontal attitude of the beds, their sandy composition and the fact that they contained plant fossils of which he found a few traces. He also noted that the Beacon is repeatedly intruded by sills and dikes of "dolerite." Since the original discovery of the Beacon, nearly every group that has inspected the rocks of the ranges in this portion of Antarctica have found the Beacon to be as originally

Fig. 13 Lower fault showing a normal fault plane and breccia. Massive sandstone forms cliffs in this zone.

Fig. 14 Zone between faults with steeper dips. First coal seam in Lower Beacon rocks shown under ice axe.

described in the area of Ferrar Glacier. Known Beacon prior to the International Geophysical Year was limited by Sir Douglas Mawson's observation on a nunatak in Adelie Land (67°S 140°E) and on occurrence in the Thorn Glacier section of the Queen Maud Mountains described by Blackburn.

The arkosic sands are always intruded by sills of diabase. Plant fossils (Glossopteris leaves and Dadoxylon wood) and small beds of coal and shale are also described from all the exposures. The sandstones commonly show cross bedding and current ripples indicating that they were deposited under terrestrial conditions in an arid climate and that the source area was relatively near at hand. The diabase sills reach thicknesses of 2,000 feet and account for more than half of the thickness in most of the sections.

In the Horlick Mountains Central Range the Beacon series differs from the other described areas in that no diabase is present (with the possible exception of a capping on a mountain not visited). In all other respects the Beacon is similar to the description of the Beacon from the other localities.

The base of the Beacon here is at the conformable contact of the dark, fissile shale with the thick, massive sandstone. This sandstone is a medium-grained, arkosic sandstone showing poor sorting and subangular grains with argillaceous cement. The over-all color is a light gray on the weathered surface and a medium gray on the fresh surfaces. Some of the sandstone and finer grained material are bedded.

The upper limit of the Beacon is not exposed here, as the rocks of the Beacon group form the summit of Mt. Glossopteris. However, the mountain to the ESE of Mt. Glossopteris showed change in lithology in the upper 200 feet of rock. This capping rock appeared to show flow structures and could be a diabase sill which caps the Beacon of the Horlick Mountains. Relative positions would place the top of Mt. Glossopteris near the top of the Beacon as seen on the nearby mountain.

The thickness measured in the ascent of Mt. Glossopteris for the Beacon series is 2,115 feet. This is a minimum figure as the section above the mountain summit has obviously been removed. In addition, faulting may have resulted in thinning of the strata as measurements were made along the ridge with an altimeter.

The general rock types of the Beacon series are a medium-grained arkosic sandstone, shale, siltstone, and coal beds. Plant remains are found in the sandstone and shales. These sediments lend themselves readily to division into lower and upper units. The Lower Beacon is bounded by the basal sandstone and a quartz pebble horizon which makes the upper limit. The dominant rock type is a medium-grained, arkosic sandstone with subrounded grains and argillaceous cement. The outcrops are a light buff color and the bedding is variable but generally thick bedded (Fig. 14). Shales are interbedded with the sands and are darker than the sands, weathering to a brownish gray with the fresh surface being a medium gray color. Mica flakes are common in the shale. An occasional coal bed is present and is usually closely associated with the slates. These coal beds are thin, from

Fig. 15 Lower Beacon rocks showing arkosic sandstones with cross-bedding. Fossil wood found where party is kneeling.

Fig. 16 Summit area of Mt. Glossopteris, face in shadow provided Glossopteris leaves and petrified wood. Summit is light ridge behind face.

Fig. 17 Upper Beacon sandstone.

Fig. 18 Upper Beacon sandstone showing thick-bedding and tendency to form ledges and cliffs.

Fig. 19 Fossilized tree stem approximately 12 feet long exposed in Upper Beacon sandstone.

Fig. 20 Coal bed in Upper Beacon group.

an inch to approximately a foot thick. The repetition of beds and abundant coals which are so characteristic of the Upper Beacon are not shown by the Lower Beacon.

The Upper Beacon extends from the pebble conglomerate to the top of the mountain. The pebbles in the conglomerate are mainly well-rounded vein quartz and fewer lithic pebbles up to an inch in diameter. Above this horizon the Beacon is cyclic and sandstone, shale, and coal occur repeatedly through a sequence 1,860 feet thick. The sandstones are medium-grained, gray, moderately hard rocks occurring in medium to thickly bedded layers. Cross-bedding and plant remains are common features of the sandstone. The largest of the stems measured was approximately 12 feet long and more than 12 inches in diameter (Fig. 19). The shales are more common in the upper beds and range from light to dark gray on weathered surfaces. Commonly they are silty or slightly sandy and well-bedded. Beds range from thin laminae to beds a few inches to a few feet thick repeatedly throughout the Upper Beacon.

The plant-bearing sands described by Blackburn from the Thorn Glacier area of the Queen Maud Range came from the "top most" strata. The heavy plant-bearing zone of the Horlick Central Range appears to be a few hundred feet lower than the highest of the sedimentary rocks.

Diabase Sills

The major difference between the stratigraphy of the Horlick Mountains Central Range Beacon and the sections of the Beacon series described in all other areas is the presence of diabase sills or flows. No diabase was seen during the inspection of more than 4,000 feet of sediments. Since only a single mountain in the Horlick Range was visited, it is possible that flow rocks are present and exposed on other peaks. Also, the rock which capped a flat mountain to the southeast of Mt. Glossopteris appeared dark and somewhat like a flow or sill (Fig. 21). It is possible that this unit could be diabase. The upper coal beds and shales show slightly baked characteristics which could indicate nearness to sills or dikes. This baking is more predominant in the upper sedimentary rocks of the section than the lower rocks which also would suggest a capping of volcanic rock.

GEOLOGIC STRUCTURE

The elevation and shape of the Horlick Mountains is governed by major block faulting or tilting and block faulting which created the steep northern escarpment that is seen in the eastern, central, and western Horlick Ranges. The vertical displacement of this faulting is in the order of 5,000 to 10,000 feet. These faults trend in the same direction as the fault system that produced the escarpment of the Queen Maud, Royal Society Range and the mountains that border Victoria Land on the west, and may be extensions or continuations of it. This system and its features have been referred to as the Antarctic Horst.

The appearance of the horst in the Horlick Mountains area is not as pronounced here because the beds dip to the south-southeast and the blocks

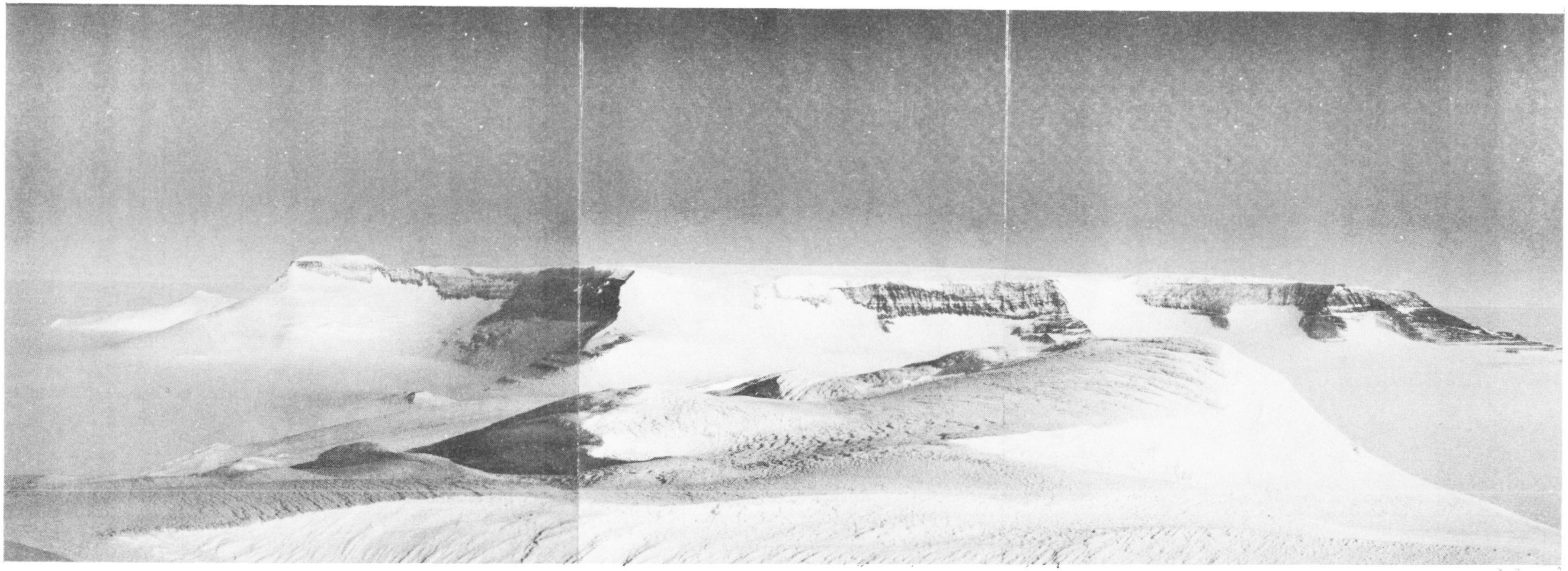


Fig. 21 Dark rock capping flat-topped mountain SE of Mt. Glossopteris, possibly a diabase sill or flow.

are tilted slightly to the south (5-15°). Faulting has occurred along the northern limit of the range and is shown by peaks which have been elevated above the level of the ice cap. The faulting, however, appears to be of lesser magnitude south of the range as the strata dip to the south. The general aspect of the range is that of tilted block with a steep escarpment on the north and smaller faults on the south.

Transverse faulting of large magnitude is probably responsible for the termination of the ranges to the east and west and the off-setting of the front of the range. The eastern half of the central range is farther south than the front of the western escarpments. The western Horlick Range presents the same aspect. Minor faults appear to parallel the main escarpment. One of these small faults is located near the base of the Lower Beacon sandstone. Here the fault is normal, dipping 60° to the south with a displacement (estimated) of less than 200 feet. A brecciated area occurs approximately 600 feet up slope from the fault with the rocks between exhibiting anamalous dips. No major displacement was noted along the extension of this zone on the face of the mountain.

The strata of the mountains are relatively undisturbed and the dip ranges from 3° to 20° southerly. The only break in the general dip is in the fault zone mentioned above where dips as high as 40° to 50° were recorded. No unconformity other than that at the base of the sedimentary series, between the sedimentary rocks and the basement, was observed. The attitudes of the beds were generally consistent throughout and consequently it is assumed that the section from the basement rocks to the Upper Beacon series at the top of Mt. Glossopteris is continuous. The low dip angles made accurate strike measurements difficult. The unconformity at the base of the section appears to be an undulating erosion surface upon which the later sedimentary rocks were deposited. This old surface is well shown near the top of the long, flat-topped nunatak that extends out from the front of the range to west of the camp at mile 414.

The structural relations of the Mt. Glossopteris area of the Central Horlick Range then appear to be related to the large magnitude block faulting and tilting, which elevated a section of relatively undisturbed sedimentary rocks to a position higher than the present day level of the ice cap.

GEOLOGIC HISTORY

Pre-sedimentary Rock History

The oldest rock exposed is the quartz monzonite basement. This intrusive rock was probably emplaced in the early Paleozoic or Precambrian. Erosion removed the cover and produced the rolling surface upon which the sedimentary rocks described in this paper were deposited. (The sediments form a sequence typical of the continental side of a geosyncline.)

Depositional History

The earliest deposits probably represent beach deposits layed down by an encroaching sea during early Devonian. Subsidence continued and was accompanied by uplift of nearby areas which served as a source for the graywackes which were poured into the basin. The more coarsely clastic rocks on the Lower Beacon series which were the next unit to be deposited probably reflect lowering of the source areas by erosion, filling of the basin, and retreat of the seas and the on-set of an environment that was certainly paludal and possibly terrestrial. Minor fluctuations of sea level probably account for the cyclic nature of the upper part of the series. The fossils of the Beacon indicate that it was exposed during the Carboniferous and Permian periods.

Post Depositional History

After the Carboniferous and Permian deposition the area was elevated above sea level. Their present position may reflect several periods of uplift, but the most recent took place in the Tertiary or Quaternary when the last upheaval raised the blocks and tilted them to form the present mountains.

CONCLUSIONS AND SUMMARY

The rocks described above were collected from outcrops in the Central Range of the Horlick Mountains and apparently represent a continuous, nearly undisturbed Beacon series and descriptions of fossiliferous and probably marine Lower Paleozoic rocks from Antarctica. Although the literature has not been extensively surveyed, apparently the only other marine fossiliferous Paleozoic rocks described have been erratics which contained Cambrian and Devonian fossils. Rocks which resemble the graywacke of the Horlick Mountains have been noted in other parts of Antarctica and it has been suggested that some of these may be Paleozoic rocks, but unfortunately these rocks have been unfossiliferous.

Several things still remain to be investigated and are currently being studied. A detailed study of the sedimentary rocks, identification of the invertebrates by Dr. G. A. Cooper, and a study of the plant remains by Dr. J. Schopf are in progress and will be published as they are completed. They will supplement this preliminary description.